Innovators

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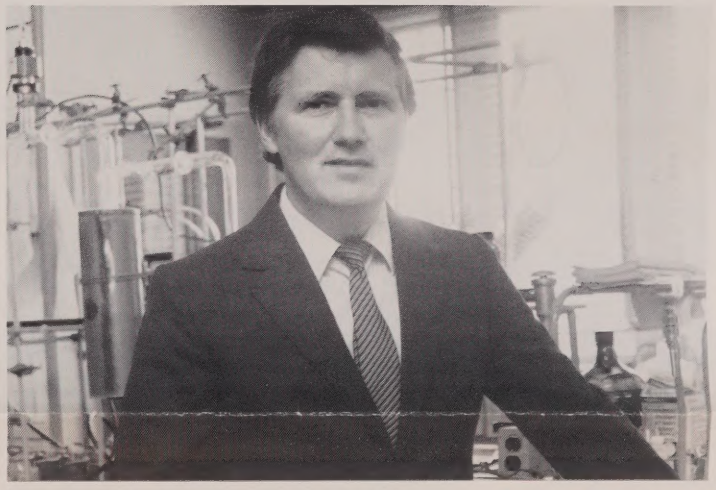
"*The Innovators*," a periodic newsletter from IDEA Corporation, is about people whose exciting ideas for new products and processes are being taken to the marketplace with IDEA's help. This issue introduces a chemistry professor at the University of Western Ontario, Dr. Richard J. Puddephatt, who has developed a more efficient use of gold compounds for the microelectronics industry.

As a student of chemistry, pure curiosity led Richard Puddephatt to explore further uses of organic gold compounds. He was intrigued by the stable and high performance of gold as a conductor, and began experimenting on his own.

Until 1982, Dr. Puddephatt's research in organometallic chemistry involved fundamental studies of an academic nature only. He wrote the only standard text on gold chemistry and has been the author or co-author of more than 185 original research articles. It wasn't until he was approached by executives in the microelectronics industry that he began applying his research to industry.

What the executives wanted to know, was how volatile gold compounds were being used in Dr. Puddephatt's experiments. The use of gold in the electronics industry had been growing rapidly, with an increasing volume of high technology applications. It is estimated close to 100 tons of gold are used in electronics yearly, and the annual cost of this raw gold exceeds a billion dollars.

Spurred on by the challenge given to him by the microelectronics industry, Puddephatt began experimenting with the gold compounds and soon realized he was limited by time and money. As a full-time professor, he did not have the long hours to devote to experimenting with the compounds. He required an assistant to spend the time on research. For the tests, he required funds to purchase gold, glassware, chemicals and solvents. This could run to almost $20,000 for the year. Puddephatt admits, "I knew that I had a good chance of making significant inroads in my experiments, but was unable to even begin without financial assistance."



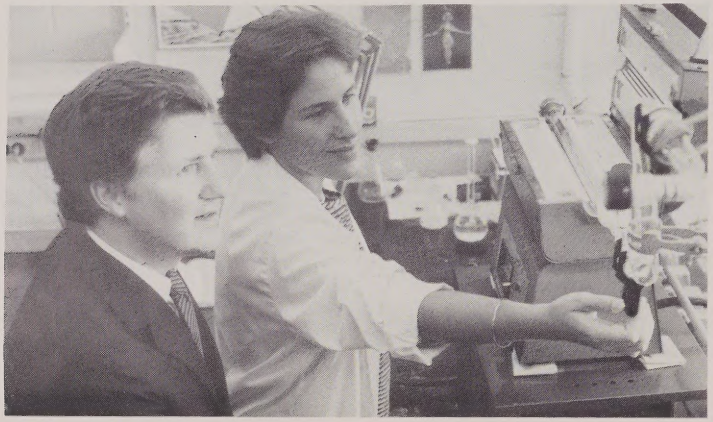
Dr. Richard J. Puddephatt
University of Western Ontario

It was in the spring of 1982 that two IDEA Corporation representatives were at Western seeking research that would have commercial potential. They spoke to Puddephatt and soon realized there was an opportunity for investment. Puddephatt was urged to submit a proposal to IDEA and in the fall of 1983 the Board of Directors of IDEA's Research Investment

Ilse Treurnicht using the "glove box," filled with nitrogen, to handle compounds that are oxygen sensitive.

Fund committed $36,000 toward Puddephatt's research, in return for the rights to original patents and to license the process. He now had the funds needed to purchase materials and hire an assistant.

Co-incidentally, shortly after Puddephatt received the funds that enabled him to continue his experiments, he received a letter from a post-doctoral student, Ilse Treurnicht, from the University of Oxford in England. A Rhodes Scholar, she had just received her Ph.D. in organic metallic chemistry and was looking for post-doctoral research work in that area. Puddephatt hired her and a month later she began working exclusively on the project.



Ilse Treurnicht, Research Assistant, setting up an experiment for Dr. Puddephatt, to demonstrate the formation of a gold mirror, formed from organic compounds.

The current use of gold

New methods of depositing gold are being sought by the microelectronics industry, since the present technology, using electroplating, is inefficient and wasteful of this expensive metal. An electric current is passed through a gold solution, depositing the gold onto a plate from the electrodes. However, it is difficult to control where the gold is being deposited.

Additionally, current thermal deposition of gold from gold phosphates results in gold films with microscopic crystalline flaws. These were the problems that Puddephatt was asked to overcome.

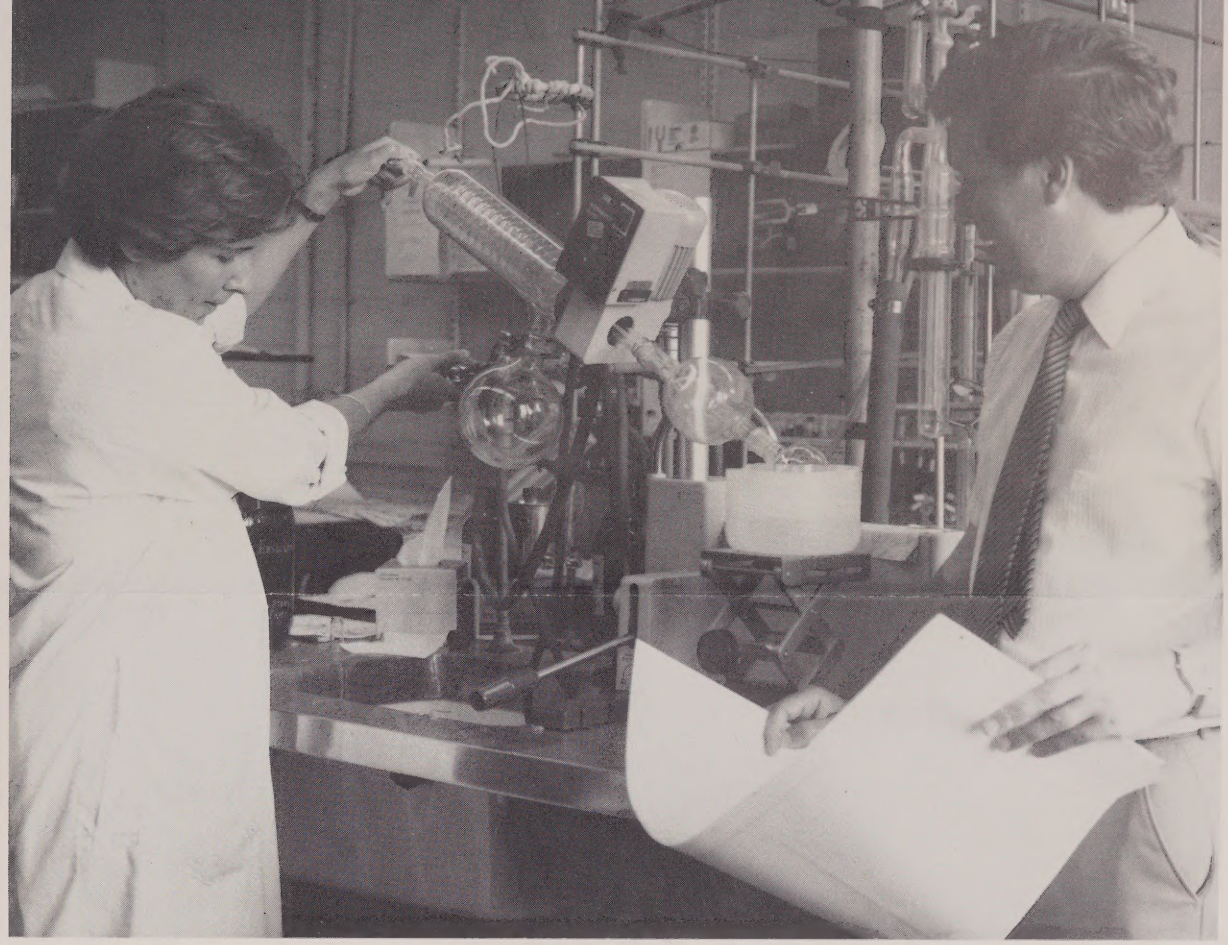
Dr. Puddephatt and his assistant realized the first step was to devise a series of organic gold compounds which would be stable and could be vaporized easily. After achieving that, they had to determine a method of heating so that the gold film, derived from the compounds, could be controlled to deposit only where heated. After countless experiments they discovered an entirely new method of depositing gold—by chemical vapour deposition. By this process, the gold compounds are heated gently to produce the vapour, and then stronger heating transforms the compounds to gold metal and forms a shiny mirror that is deposited evenly on the wafers. This method also results in greater film protection, needed for the most advanced microelectronics applications.

Licensing opportunities

During the years 1984 through '85, when Dr. Puddephatt and Ilse Treurnicht were busy in the research lab perfecting the method of depositing the gold compounds, IDEA was busy too—working on the commercialization process of Puddephatt's discovery. Canadian and U.S. patent applications were filed for Puddephatt's technology. Once these were obtained, a search began across the country and internationally for licensing opportunities. IDEA is optimistic about the reactions received to the professor's research. Says IDEA President Harold W. Blakley, "I'm frankly quite excited by the licensing possibilities. If Dr. Puddephatt's success in working with gold compounds can be duplicated in the manufacturing process, we could be looking at a market in the electronics industry alone, of over a billion dollars worldwide a year."

The challenge for the future

The most volatile known gold compounds have already been developed by Dr. Puddephatt and the feasibility of chemical vapour deposition of gold has been demonstrated. The next stage is to prepare still better gold compounds



Dr. Puddephatt supervising Ilse Treurnicht using the "Rotavapor," a machine that removes solvents from the gold compounds.

and determine optimum temperatures and conditions for deposition of gold to bring the technology closer to commercial application. To assist Puddephatt in achieving these goals, IDEA has committed a second investment of $62,500 for the year 1985-86.

It is anticipated a license may be signed with a company in New Brunswick for the gold coating of gallium arsenide wafers—gold-coated wafers used in microelectronics applications. Over the next year Puddephatt will be supplying this company with gold compounds for pilot scale testing, and work directly with them to determine the most convenient way of handling and packaging the gold compounds. The gold-coated wafers will also be analyzed by Puddephatt for evenness, depth and purity. There also appears to be the possibility of a second license in Ontario for the manufacture of the gold compounds themselves.

The next year is a crucial one for Dr. Puddephatt. Now that his experiments with volatile organogold compounds for gold coating applications in the research lab have been successful, he has to ensure the technology will be transferable into the manufacturing companies. Declares Puddephatt, "By the progress we have achieved to date, and the demand in the marketplace, the commercial potential for such work is becoming increasingly clear." ▼

Dr. Richard Puddephatt
After receiving his B.Sc. in Chemistry at University College in London, England, Dr. Puddephatt focused his Ph.D. degree on organometallic chemistry. Over the seven years that he has been Professor of Chemistry at the University of Western Ontario (UWO) in London, Ontario, he has become renowned for his work in this field. In 1984 he was awarded the prestigious Alcan Lecture Award from the Chemical Institute of Canada for his contribution to organic chemistry research. UWO also has recognized Dr. Puddephatt's contributions to organometallic chemistry, citing him for the 1985 Florence Buck Science Award.

Members of the Varsity Seed Fund Investment Committee—(l.-r.) Pauline Walsh, Executive Director, Innovations Foundation; Brian Marshall, President and Director, Royal Bank Venture Capital Limited; Daryl Logan, Vice-President, Innovation Assistance, IDEA Corporation.

Funds to help University inventions find commercial markets

IDEA Corporation and the University of Toronto Innovations Foundation signed an agreement to create an experimental seed finance fund, the "Varsity Seed Fund," to promote the commercialization of promising research results at the University of Toronto. IDEA will provide $100,000 for the first year to invest in early commercial investigations for up to ten projects. IDEA and the Foundation, the commercial agent of the University of Toronto, will then review the Fund's operations and amend and expand its activities. The Fund is believed to be the first of its kind in Canada.

Geoffrey Adamson, former Executive Director of the University of Toronto Innovations Foundation said "The University of Toronto has, at any time, more than 1,000 active research projects in medical, engineering and natural science fields and more than ten percent of these produce initially-promising inventions. However, it is extremely difficult to make sound business decisions regarding commercial development at the 'research result' or 'invention disclosure' stage of these projects.

"The Varsity Seed Fund will provide initial capital to support the Foundation's need for qualitative information in making these business decisions. It will also influence companies and investors in making decisions regarding participation in further commercial development. The Varsity Seed Fund addresses a crucial funding requirement that is not currently served by any other government funding program."

The Chairman of IDEA Corporation, H. Ian Macdonald, said "We must get more ideas and inventions out of our university and research laboratories and into production so that the Ontario economy can benefit from them. The Varsity Seed Fund will provide cash needed to assess the commercial potential of research and so bridge the critical gap between the lab bench and the point at which the private sector is prepared to invest in the commercialization of an invention.

"It is fitting that our first seed fund should be created for the Innovations Foundation, as we share a common goal: to bring our Ontario economy the benefits of university research."

The Fund will be managed by an investment committee consisting of Daryl Logan, Vice-President, Innovation Assistance, IDEA Corporation; Pauline Walsh, Executive Director, Innovations Foundation, University of Toronto; and Brian Marshall, President and Director, Royal Bank Venture Capital Limited, who has agreed to serve for the Fund's initial year.

Investments may be made for any of the following purposes: to assess the commercial viability of an invention, for example, through market research or in-situ testing; to develop business plans for a new company or a new market; to fund critical technical development work; or to register patents in Canada and the U.S.A.

In return for its investment in the Fund, IDEA will be well placed to invest where equity investment opportunities emerge and will have the option to recover its investment with interest or to share in the cash flows, should the invention be commercialized through licensing to an existing company.

A similar experimental Fund has been signed with York University. IDEA will provide $50,000 for the first year to invest in inventions at York that have potential for succeeding in the marketplace.

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